

Seasonal variation affects the quantity and composition of milk produced in water buffaloes - case study in Shatrah city of Iraq

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This study was conducted at Thi-Qar Governorate, Al-Shatrah district, Al-Bidaah region, in Iraq during two seasons winter (from Dec-Feb, 01.12.2021 to 01.03.2022), and summer (Jun-Aug from 01.06 to 01.09. 2022). The quantity and composition of milk of water buffaloes for Fat, Solid-Not-Fat (SNF) Protein and Lactose) were studied. Seventy (70) dairy buffaloes of different ages, in second parity among two seasons were used, and their productivity was monitored for a full lactation (from birth to dryness). Milk samples were taken periodically, once every two weeks, at a rate of 100 ml for each sample. The results of the study showed a significant ($P < 0.05$) superiority for the winter season in the amount of milk produced daily and monthly compared to the summer season, and the average daily and monthly milk quantity for winter and summer seasons were as 0.26 ± 8.03 , 7.75 ± 240.36 , 0.18 ± 4.60 , 5.44 ± 137.5 , respectively. As for the main components of milk (fat, SNF protein and lactose), a significant effect of the season appeared on the main components of milk, where the winter season was significantly superior ($P < 0.05$) in all studied traits compared to the summer season, and the average percentages of fat reached the SNF, protein and lactose in the winter and summer seasons were as follows: (0.47 ± 5.92 , 0.45 ± 8.77 , 0.013 ± 3.21 , 0.25 ± 4.93) (0.49 ± 4.31 , 0.46 ± 7.30 , 0.017 ± 2.70 , 0.72 ± 4.17), respectively. it can be concluded that season strongly affects milk yield, fat and also protein of water buffaloes in Iraqi climatic conditions.

Keywords: Water buffalo, winter and summer; the quantity and quality of milk.

INTRODUCTION

The Iraqi buffalo is classified within the rivers buffalo belonging to the Bovidae family, the genus *Bubalus bubalis*. It is spread in all governorates of Iraq from the south to the north, and the number of Iraqi buffaloes, according to the statistics of the Ministry of Agriculture in 2008, amounted to 285 thousand head; 60% of this number is found in the southern and central Iraq (Ministry of Agriculture, 2008). Buffalo is considered an important part of the livestock in Iraq because it provides materials of high nutritional value, such as milk, meat, leather and other products that are basic raw materials for a number of food and leather industries, and the percentage of buffalo contribution to milk production in Iraq amounted to 5-8% (FAO, 2003). Buffalo milk has a value that exceeds the nutritional value of cow's milk because it is rich in fats, proteins, sugars, minerals and other substances (Habib, 2004). Ali (2010) indicated that the percentage of fat in buffalo milk reaches between 7-10%, which is twice the percentage of fat in cows, and for these reasons, buffalo milk has been made a primary material in the manufacture of dairy

products such as cream, cheese, curd and butter. Milk production and composition are affected by genetic, non-genetic, and environmental factors (Ali *et al.*, 2020). Rashidi *et al.* (2008) and Yavarifard *et al.* (2015) indicated that milk production's characteristics are affected by many factors, such as breed, age, sex of the newborn, season and health status. The composition of milk is affected by many factors, including seasonality, genetics and the stage of production, and environmental factors (Bucci *et al.*, 2002). Qutb (2006) indicated that the quantities of milk produced decrease during the summer season as a result of the effect of high temperatures in this season, which negatively affect milk production, while Abbas *et al.* (2011) indicated that there is a significant effect of the season of the year on the main milk components.

MATERIALS AND METHODS

This study was conducted in Iraq, at Thi-Qar Governorate, Al-Shatrah district, Al-Bidaah region during the period from 01.12.2021 to 01.03.2022, as this period represents the winter

season (December-February) and from 01.06.2022 to 01.09.2022, this period represents the summer season (June-August). In this study, 70 dairy buffaloes of different ages (second parity) and production seasons were used, herd productivity was monitored from full lactation (birth to dryness), and the herd was fed according to the available fodder in that season.

The amount of milk for each buffalo was estimated once per week using a balance to calculate the amount of daily and monthly milk production. The buffaloes were milked once a day in the morning by manual milking.

Milk samples were taken periodically, once every two weeks, at the rate of 100 ml for each sample. The samples were kept immediately after collection in a box filled with crushed ice. Then they were transferred to the laboratory for analysis by a German-made EKO MILK device (Make, model or any number). The percentage of fat, SNF, protein and of lactose by this device.

The data were analyzed statistically using the ready-made statistical program (SPSS 2006), and the significance of the means were tested using the LSD test.

RESULTS AND DISCUSSION

Table 1 shows standard of milk yield and composition of milk (nutrients) in different region of Iraq. We discussed based on findings of the Table 1.

Table 2 shows the average effect of the season (winter, summer) on the daily and monthly amount of milk produced, where a significant ($P < 0.05$) superiority was observed for the winter season compared to the summer season; 0.26 ± 8.03 , 7.75 ± 240.36 , 0.18 ± 4.60 , AND 5.44 ± 137.5 , respectively.

The reason for the decrease in daily and monthly milk production in the summer should be due to high temperatures, which lead to a decrease in milk production and a decrease in feed consumption as a result of a decrease in the level of the hormone thyroxine, which leads to a decrease in the animal's appetite as a reaction to the high temperatures (Hurley, 2003). Alternatively, as a result of an increase in the supply of blood to the surface of the skin to supply the sweat glands with the energy needed to secrete sweat, and then the blood destined for the udder decreases, which leads to a decrease in milk production (Al-Qudsi and Elia, 2010). The results of this

study agreed with Marai and Habeeb (2010), Bahashwan (2014), Al-Fayad (2015) and partly with Bhattarai (2020).

Table 2. mean (\pm standard error) effect of winter and summer seasons on daily and monthly milk production.

The season	Daily milk production (kg)	Monthly milk production (kg)
winter	$8.03 \pm 0.26A$	$240.36 \pm 7.75A$
summer	$4.60 \pm 0.18B$	$137.50 \pm 5.44B$

Different letters within one column indicate significant differences ($p < 0.05$)

Table 3 shows the average seasonal effect of winter and summer on the main components of milk (fat%, non- solid fat, protein%, lactose %). Through the results, it was found that there was a significant effect of the season on the main components of milk, where the winter season was significantly superior ($p < 0.05$) compared to the summer season by a percentage of fat, percentage of non- solid fat, percentage of protein, and percentage of lactose. The average percentages of the leading milk components for the winter and summer seasons were as follows: (0.42 ± 5.92 , 0.45 ± 8.77 , 0.013 ± 3.21 , 0.25 ± 4.93) (0.49 ± 4.31 , 0.46 ± 7.30 , 0.017 ± 2.70 , 0.27 ± 4.17), respectively. In terms of fat percentage, the results of this study agreed with Abdullah (2018), Veena *et al.* (2020), and Al-Mohamed *et al.* (2021).

As for the percentage of non-fat solids, the results of this study agreed with ABD (2013) and with Bhattarai (2020); in the percentage of protein, the results of this study agreed with what was reached by Al-Muhamid *et al.*, (2021), as well as in the percentage of lactose, the results of this study agreed The study is based on the findings of Yadav *et al.*, (2013) and Al-Muhamid *et al.* (2021).

The decrease in the proportions of the main components of milk in the summer compared to the winter season may be attributed to the effect of high temperatures, which led to a decrease in milk production as a result of the animal's appetite being negatively affected by the high temperatures, and thus a decrease in feed consumption. The change in milk components results from a change in the animal's appetite (Al-Kaabi, 2005). It increases body temperature, and thus the fat percentage in milk decreases compared to the winter season.

Table 1. Milk composition and milk production of buffaloes in Iraq.

Daily milk (kg)	Fat (%)	Protein (%)	Region of study	Reference
6.47-8.92	3.77-4.15	5.89-6.25	Hashemia	Al-Zarkan <i>et al.</i> (2020)
7.02	6.17	3.83	AL-Muthanna p	Alkhateeb <i>et al.</i> (2021)
3.71-11.14	4.84-5.96	3.38-4.69	Shatra district	Al-Fayad <i>et al.</i> (2022)
7.20-8.09	3.87-5.63	3.26-3.47	Al-Mishkhab	Al-Ghalibi <i>et al.</i> (2021)
5.76	5.8	-	Thiqr province	Idris & Khlef (2007)



Table 3. Mean (\pm standard error) effect of winter and summer seasons on the main components of milk.

The season	%Fat	Non-f solid fat %	%Protein	Lactose %
winter	5.92 \pm 0.47A	8.77 \pm 0.45A	3.21 \pm 0.013A	4.93 \pm 0.25A
summer	4.31 \pm 0.49B	7.30 \pm 0.46B	2.70 \pm 0.017B	4.17 \pm 0.27B

Different letters within one column indicate significant differences ($p < 0.05$).

Fat percentage in winter in data of present study (table 3) is greater than Al-Zarkan *et al.* (2020), Al-Ghalibi *et al.* (2021), and Idris and Khlef (2007) (table 1) that they studied without description of season or climatic effects on animal products. Also milk protein in winter season (table 3) is less than all of collected data with other researchers (table 1).

As well as, for total milk yield of buffalo, 8.03 kg/d in winter (Table 2) is in range of optimize production level for local buffaloes, when we see previous reports in different district of Iraq.

Conclusion: Based on present findings and also comparative studies with previous works, it can be concluded season strongly affect milk yield and milk fat and also milk protein of buffaloes in Iraq climatic condition (higher fat content in winter-milk). Present findings seems is complete finding for previously published works.

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